REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-13 are pending in the present application. Claims 1, 7, and 12 have been amended by the present amendment.

In the outstanding Office Action, Claims 1-5, 7-10, and 12 were rejected under 35 U.S.C. § 103(a) as unpatentable over European Patent Application No. EP 0 762 471 to Miyata et al. (hereinafter "Miyata") in view of U.S. Patent No. 6,014,943 to Arami et al. (hereinafter "Arami"); and Claims 6 and 11 were rejected under 35 U.S.C. § 103(a) as unpatentable over Miyata in view of Arami, and further in view of U.S. Patent No. 5,717,294 to Sakai et al. (hereinafter "Sakai").

Initially, applicants and applicants' representative wish to thank Examiner McDonald for the interview granted to applicants' representative on November 20, 2003. During that interview, the outstanding rejections and presently submitted claim amendments were discussed in detail. Further, applicants' representative presented arguments distinguishing the amended claims over the applied art. No agreement was reached, but Examiner McDonald tentatively indicated the amended claims appear to overcome the current rejections. Examiner McDonald further indicated he would consider the amended claims when formally presented in a filed response.

Figures 3 and 5 are amended by the present amendment. Figure 3 is amended to (1) show that the magnetic field B runs in the direction N to S, as shown in Figure 2 and explained at page 16, lines 6-9 of the specification, and (2) label the bottom electrode with the reference numeral "16". Further, Figure 5 is amended to underline the reference letters "a" and "b", in order to maintain conformity with the reference letters "a" and "b" of Figure 2, which refer to the same anisotropic segment magnets.

Addressing now the outstanding rejection of Claims 1-5 under 35 U.S.C. § 103(a) as unpatentable over Miyata in view of Arami, and of Claim 6 further in view of Sakai, those rejections are respectfully traversed.

Amended Claim 1 is directed to a magnetron plasma processing apparatus for subjecting a target substrate to magnetron plasma processing. The apparatus includes, in part: electric field forming means for applying an electric field to the processing space accommodating the target substrate; and magnetic field forming means for applying a magnetic field to the processing space.

The magnetic field forming means includes a dipole ring magnet, which includes: a plurality of first anisotropic segment magnets (hereinafter "first magnets"); one or more second anisotropic segment magnets (hereinafter "second magnets"); and one or more third anisotropic segment magnets (hereinafter "third magnets").

The first magnets are arranged in a ring-like shape around the outer wall of the plasma processing chamber and form a magnetic field gradient that is both perpendicular to an electric field formed by the field forming means and that increases in strength along an electron drift direction.

The second magnets are arranged proximate to a predetermined region. Further, the second magnets each have an N pole directed toward the predetermined region and collectively have a net magnetic force directed radially toward the center of the dipole ring magnet.

The third magnets are also arranged proximate to the predetermined region. Further, the third magnets each have an S pole directed toward the predetermined region and collectively have a net magnetic force directed radially from the center of the dipole ring magnet.

By this arrangement, the second and third magnets locally increase the magnetic field strength of the predetermined region, such that the magnetic field strength of the predetermined region is larger than would otherwise be contributed by the first magnets alone.

The increase caused by the second and third magnets is shown by a comparison of Figures 2, 5, and 6. In a non-limiting example, Figures 2 and 5 depict one configuration of the first 22, second a, and third b magnets of the claimed dipole ring magnet (page 9, lines 3-5 and 13-15). Figure 6 depicts a corresponding configuration of a conventional dipole ring magnet (page 9, lines 16-18). As shown, the claimed and conventional dipole magnets differ by the orientation of the second a and third b magnets, which each have magnetic N and S poles directed toward the predetermined region A (page 18, lines 23-27), and which collectively have net magnet forces directed toward and from the center of the claimed dipole ring magnet (as shown), respectively. Because of this arrangement, the magnetic field strength of the region corresponding to the predetermined region A is substantially greater than other regions (page 19, lines 7-15).

As shown in Figure 7, the difference is especially pronounced at distances greater than 150 mm from the center of the dipole ring magnet (from E to W), but barely evident at distances less than 150 mm. Consequently, unlike conventional apparatuses, the present invention can sharply and substantially increase the magnetic field strength of a region lying just outside the E side edge of the substrate 30 (page 19, lines 16-21), without substantially increasing the magnetic field strength of a region on the surface of the substrate 30. In this manner, the present invention addresses a recent need to increase the amount of plasma generated within a process chamber,[1] while maintaining a low magnetic field strength across

[1] Plasma density increases with magnetic field strength (page 16, lines 13-14)

the surface of the substrate (page 17, lines 2-16). None of the applied references teach this advantage.

Only Miyata is cited as teaching the structure of the claimed dipole ring magnet (Office Action, August 21, 2003, page 2). More particularly, the magnets 50(7) and 50(3) of Figure 7A are cited as teaching the claimed second and third magnets (Office Action, August 21, 2003, page 4). However, these magnets do not generate a magnetic force that is directed radially toward or from the center of a dipole ring magnet. This is likely because the object of Miyata is to provide a means of offsetting electron drift, by increasing the magnetic field of the dipole ring magnet in a horizontal direction (col. 2, lines 26-34). Thus, unlike the claimed invention, Miyata does not teach a means of increasing magnetic field strength within a localized region located outside of the substrate by redirecting the poles of magnets within the dipole magnet ring. Accordingly, with respect to independent Claim 1, and Claims 2-6 depending therefrom, Applicants respectfully request these rejections be withdrawn.

Addressing now the outstanding rejection of Claims 7-10 under 35 U.S.C. § 103(a) as unpatentable over Miyata in view of Arami, and of Claim 11 further in view of Sakai, those rejections are respectfully traversed.

Similar to the rejections of Claims 1-6, the rejections of Claims 7-11 cite Miyata as teaching the claimed dipole ring magnet. Like amended Claim 1, amended Claim 7 similarly recites two sets of one or more anisotropic segment magnets, each having N and S poles directed toward and from a predetermined region located outside the substrate, and collectively generating net magnetic forces directed radially toward or from the center of the dipole ring magnet. Accordingly, for the reasons stated with respect to the rejections of Claims 1-6, Applicants respectfully request the rejections of Claims 7-11 be withdrawn.

Addressing now the rejection of Claim 12 under 35 U.S.C. § 103(a) as unpatentable over Miyata in view of Arami, that rejection is respectfully traversed.

Amended Claim 12 is directed to a magnetron plasma processing apparatus for subjecting a target substrate to a magnetron process. The apparatus includes a process gas chamber; a pair of opposing electrodes arranged in the chamber and defining a processing space therebetween; and electric field forming means for applying a voltage to the pair of electrodes, thus forming an electric field in the processing space.

Amended Claim 12 further recites first and second magnetic field forming means. The first magnetic field forming means form a first magnetic field, such that a magnetic field strength of the first magnetic field is large and small on upstream and downstream sides, respectively, of the chamber in the electron drift direction. The second magnetic field forming means increases the magnetic field strength at one or more predetermined regions, which are located proximate to and outside of that end of the target substrate which is on the upstream side in the electron drift direction.

As amended, Claim 12 further recites that the first and second magnetic field forming means form a maximum field strength of 200 Gauss above the target substrate and a minimum magnetic field strength of 200 Gauss at the predetermined regions (for support, see Claims 6 and 11 as originally filed; see also page 8, lines 20-25).

Neither Miyata nor Arami teach magnetic field forming means achieving the claimed maximum and minimum magnetic field strengths within the regions recited in Claim 12. Accordingly, Applicants respectfully request the rejection of Claim 12 be withdrawn.

New Claim 13 recites features similar to those recited in Claim 12. However, instead of reciting maximum and minimum magnetic field strength values, Claim 13 recites that the magnetic field strength increases by more than 500 Gauss over the range of 150 mm to 250 mm from the center of the first magnetic field forming means, along the electron drift

direction (for support, see Figure 7 and page 19, lines 15-16). Thus, Claim 13 recites rate of change in magnetic field strength that is not taught by any of the applied references. Accordingly, Applicants respectfully submit that Claim 13 is in condition for allowance.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance, and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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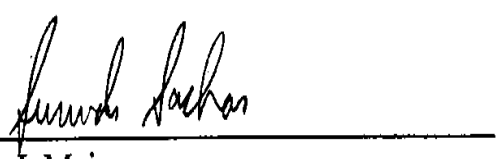

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